SMART ESTATES TALENT PLAYBOOK

Developing Future Capabilities in Singapore's Built Environment

An initiative of

SKILLSFuture SG

INFOCOMM MEDIA DEVELOPMENT AUTHORITY

In collaboration with

Building and Construction Authority

Knowledge partner

eden strategy institute

About this playbook

This playbook aims to inform and inspire companies across the Built Environment value chain about the opportunity presented by Smart Estates development under the nationwide Smart Estates Initiative. More importantly, it seeks to equip companies with the knowledge and awareness of the capabilities that businesses must develop to take advantage of the industry-wide transformation that is underway. This playbook is part of the first-of-its-kind **Smart Estates Talent Development Programme (SETDP).** Led by SkillsFuture Singapore (SSG) and the Infocomm Media Development Authority (IMDA), in collaboration with the Building and Construction Authority (BCA), this is a skills and talent partnership to develop future-ready talent that will build capabilities for estates of the future.

To achieve this, the playbook presents highlights from a global scan of emerging areas in Smart Estates development, as well as five future scenarios of Smart Estates which demonstrate how business, operating, and service models might change across the value chain. These give rise to new and emerging job roles, which were co-created with firms across the Built Environment value chain, including architects, developers, technology solution providers, facilities management companies, consultancy firms, and industry trade associations.

The playbook provides practical information and guidance on specific capabilities and skills which companies can prioritise in training, expressed as future job roles for Smart Estates, allowing them to respond to technological advances and pressing business challenges to achieve business success.

How can I use this playbook?

Companies across the built environment can use this playbook as a tool to:

- Compare your developments against industry good practices
- Gain awareness of international trends, practices, and emerging technologies for the Built Environment
- Identify new opportunities and areas for value creation offered by Smart Estates development (e.g. new business, service, and operating models)
- Understand the capabilities and skills required to develop and operate future job roles in Smart Estates
- Understand the resources and support that is available to your company to begin building talent for future Smart Estates

Each future job role includes a set of key tasks and responsibilities that unlock new sources of value for firms, and offers a glimpse into the competencies required to transition from an existing role.

We trust that the playbook will spark meaningful discussions within your company of how your workforce can continue to meet future business needs, challenges, improve productivity, perform higher-value added tasks, and expand existing job scopes.

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Introduction to Smart Estates

Image credit: ake1150sb via iStock

The year is 2025.

Walter, aged 36, is the office manager of Asia's latest unicorn start-up, whose headquarters are situated at Singapore's newest Smart Estate.

It's Monday morning and he makes an early start through the park connector, and stores his bicycle at his office building. He spots an autonomous cleaning robot drying up a spilled drink on the floor, and remembers his request the day before to the estate manager to approve the renovation contractor for his office remodeling.

He checks on the estate mobile application and notices that he had already received a notification informing him that his request has been approved. Walter is pleased with how seamless the automated process has been, which would allow his new staff to settle into the office space as quickly as possible. He recalls how his lease was also able to accommodate his needs for flexible contractual terms, and feels delighted with the efficiency of his estate manager.

Since the application is open, he checks on his firm's energy usage that month, and accepts the system's advice to optimise the temperature and lighting settings of the office, so as to help his team become more productive while reducing costs at the same time.

When he steps out of the lift at his floor, he is greeted by a friendly technician who is replacing the corridor lights. The technician shares that the lighting will soon start to flicker, as informed by his Building Information System that receives live data on all tagged assets across the eight buildings in the Smart Estate.

Stepping into the office, Walter's first appointment is a coffee chat with a potential business he was match-made with through the estate application, whose office is in the same building. *Our collaboration is going to be much smoother because we'll be able to catch up so easily*, he tells himself.

This is the start of a great day.

The experience in tomorrow's Smart Estates embodies Singapore's Smart Nation goals to improve working, living, and playing, enabled by technologies.

The Smart Estates Initiative

Image credit: Kenneth Cheong via iStock

Driving Innovation for Smart Estates

As part of Singapore's Digital Economy efforts, IMDA has been working with property developers, technology and solution providers, and Built Environment service providers to co-develop and test innovative urban solutions to achieve greater effectiveness and efficiency in designing and managing Smart Estates. To do so, IMDA has launched the **Smart Estates Initiative,** focusing on three strategies:

1. Forming strategic public-private partnerships to strengthen the Smart Estates ecosystem by developing new technology capabilities

2. Building innovative technologies and identifying market opportunities to deploy and scale Smart Urban solutions locally and overseas

3. Developing Smart Estates talent and driving thought leadership to enable the effective use of digital technologies and solutions throughout the Smart Estates lifecycle

Strengthening business partnerships and the ecosystem

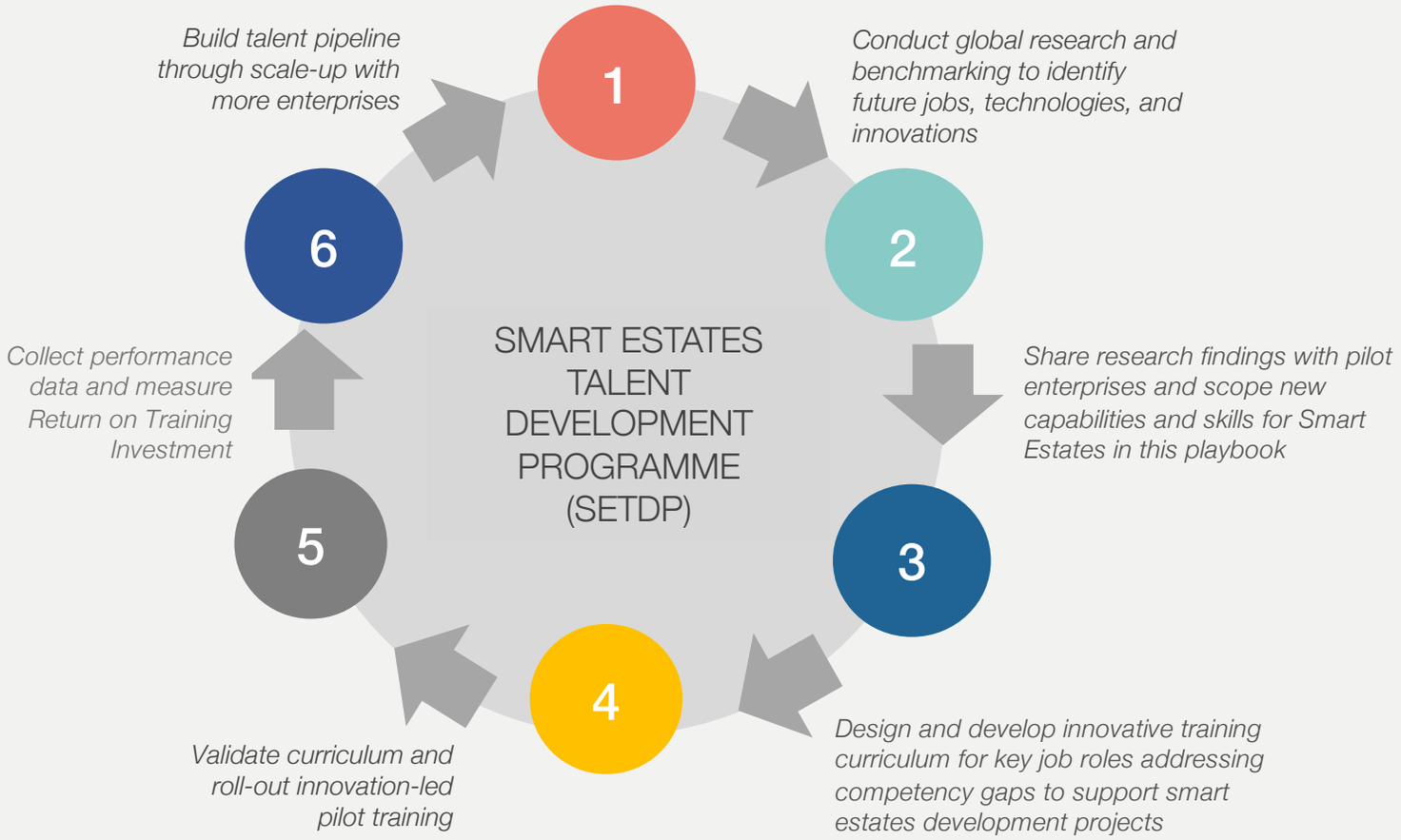
Building technology and innovation capabilities

Developing talent in Smart Estates and driving thought leadership

Equipping talent with new skills and competencies that enable the effective use of digital technologies and solutions throughout the Smart Estate lifecycle is vital to facilitating the development of future estates. This means that companies need to plan ahead, grow their future pipeline, and invest in new capabilities and skills. A recent study across global lead firms have also shown that it can cost as much as **six times more to hire from the outside than to build from within**. Therefore, the government is working with industry stakeholders to co-create a new talent development programme to support forward-looking companies as they kickstart this journey.

The **Smart Estates Talent Development Programme (SETDP)** is a strategic initiative introduced by SSG and IMDA, in collaboration with BCA, to envision the future jobs, skills and competencies, and the talent pipeline needed to support the Smart Estates ecosystem of tomorrow. It builds on the different Skills Frameworks, including the Skills Framework for Built Environment, to assemble the various jobs, skills and competencies required of future job roles for Smart Estates.

Through a six-stage approach, the talent and skills initiative will bring in industry demand drivers to scan future jobs, develop an integrated Smart Estates training curriculum, carry out the training and measure the impact. The curriculum will leverage integrated work and study training formats which combine classroom training, blended learning, on-the-job training, and mentorship to support upcoming development projects locally and internationally.

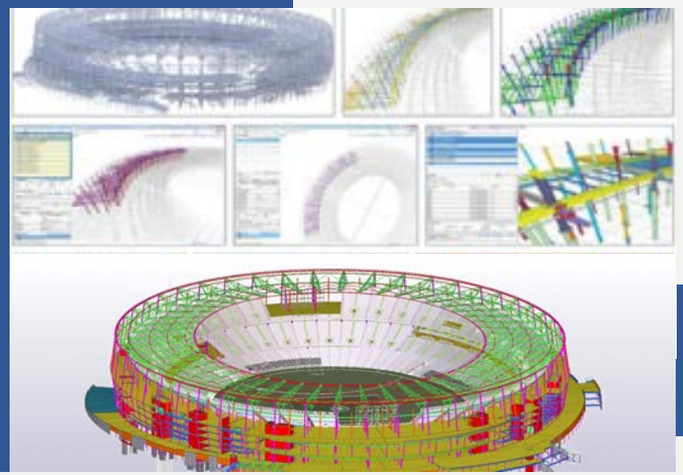

1
Conduct global research and benchmarking to identify future jobs, technologies, and innovations
2
Share research findings with pilot enterprises and scope new capabilities and skills for Smart Estates in this playbook
3
Design and develop innovative training curriculum for key job roles addressing competency gaps to support smart estates development projects
4
Validate curriculum and roll-out innovation-led pilot training
5
Collect performance data and measure Return on Training Investment
6
Build talent pipeline through scale-up with more enterprises
SMART ESTATES TALENT DEVELOPMENT PROGRAMME (SETDP)

What are the emerging capabilities of Smart Estates globally?

USD 43.5 billion will be invested in developing smart cities across Asia-Pacific ex-Japan by 2021. Smart Estates help scale up smart building technologies, to eventually give rise to smart cities that are more responsive, sustainable, inclusive, and liveable.

As the economy shifts from traditional industry silos to integrated digital ecosystems, businesses will thrive if they focus relentlessly on being able to continuously create new value, incorporate the principles of Services 4.0[1], which envisions services to be end-to-end, frictionless, empathetic and being able to anticipate customer's needs, and build on digital economies of scale. With the popularisation of deep technologies such as Artificial Intelligence (AI), Internet of Things (IoT) devices, Immersive Media (AR/VR), and cloud-based technologies, players in Built Environment – developers, architecture and planning firms, construction firms, equipment and technology suppliers, estate management companies as well as their security, cleaning, and maintenance partners – will see the entire Built Environment value chain transformed as firms invest in new capabilities.

The incidence of estates embracing smart technologies is relatively nascent, compared to the well-developed spaces of smart buildings and smart cities. This section therefore presents an international scan of innovative methods and emerging technologies that may be relevant to Smart Estates, to inspire firms across the Built Environment on how smart building and management technologies might be applied and integrated at the estate level.



Stadium model on Tekla software
(Image credit: Tekla BIM Awards)

How might we able to fully integrate multi-stakeholder groups in the design, project, and construction planning of multiple buildings within an estate?

ARUP and PDC Group collaborated in the construction of the 60,000 seat Optus Stadium in Perth, utilising a BIM-based engineering strategy which aims to achieve greater project planning foresight and better stakeholder co-ordination to optimise resource and manpower allocation for complex projects.

Their strategy employed computational design, model sharing and feedback capabilities, as well as digital model validation software which automatically integrates into the design process using Tekla software solutions. The digital model validation tools achieved **50 percent savings** on checking and rework engineering design time, completing the full stadium **three weeks early.**

Aerial view of completed Optus Stadium, Perth
(Image credit: Tekla BIM Awards)

In situ Fabricator constructing 3D mesh structure for formwork and reinforcement (Copyright Roman Keller / NCCR Digital Fabrication)

Completed DFAB HOUSE, featuring a lightweight translucent façade with thermal insulation properties (Copyright Roman Keller / NCCR Digital Fabrication)

How can complex estate designs be realised safely, efficiently, and sustainably with innovative construction technologies?

Seven professorships from ETH Zurich, under the umbrella of NCCR Digital Fabrication, and various industry partners collaborated to integrate a combination of digital construction technologies for smarter, material-efficient buildings, prototyped in the DFAB House.

This included a context-aware mobile on-site construction robot with autonomous repositioning and localisation capabilities; a Smart Dynamic Casting (SDC) to mold complex concrete structures using a single moving formwork; planning software to embed fabrication parameters, optimise design, detailing, and cost control; and computational design and 3D printing software for just-in-time prefabrication and production.

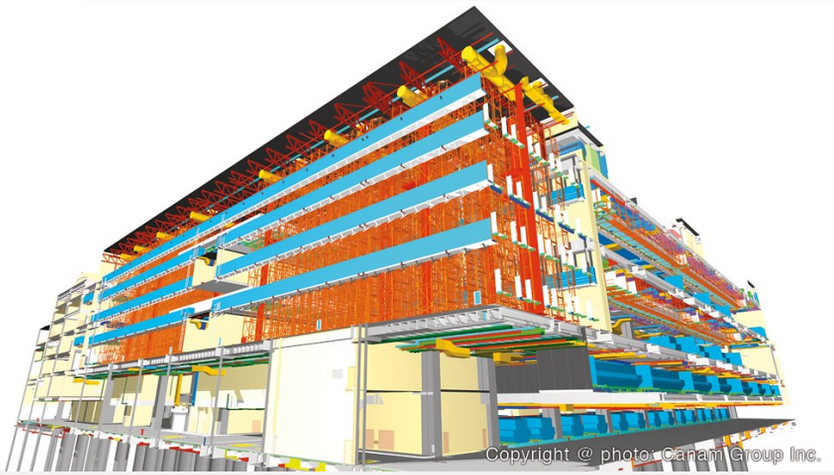


Illustration of building model (Image credit: Canam Group Inc.)

While it may traditionally take one to two weeks to plan and approve inter-tenancy stairs between two floors, this can now be **reduced to five minutes,** significantly speeding up the time taken to introduce building changes.

Maintenance requests are also processed **more seamlessly** compared to when building managers had to manually retrieve asset records and warranties.

How can digital technologies help in automating Estate Management?

Investa and Willow collaborated to use Digital Twin Technology which involved Spatial Intelligence Graphing, using spatial, live, and static data to model relationships of people, places, and devices. This greatly helps to optimise space utilisation, improve occupant experience, and increase productivity.

(Image credit: Theerapong28 via iStock)

Why should businesses invest in building future capabilities?

New technologies, business, service, and operating models will transform the Built Environment value chain for Smart Estates, and businesses have an unparalleled opportunity to take advantage of productivity boosts and costs savings.

The case for investing in future Smart Estate capabilities is strengthened even further when we consider the various challenges that businesses are facing today, such as:

- Higher expectations driving project complexity as customers grow in sophistication
- Rising competition and the need for novel and innovative value propositions to enhance business' market position
- New technology applications disrupting business-as-usual in the Built Environment
- Stringent requirements in regulatory and standards requirements
- Stakeholder demands for sustainability impact
- More frequent changes developer asset portfolios

To attend to these disruptions, businesses need to rapidly adapt and explore the potential of emergent technologies such as sensor networks, building analytics, modelling, simulations, virtual collaboration platforms, and robotics, as they may apply to the Smart Estates of tomorrow.

At the same time, technology investments only translate into core capabilities when companies also plan for breakthrough operating, service, and business models. These demand new skills that will be required of present and incoming talent, which inform changes to job roles as we know them today.

Investing in human capital will help attract and retain talent in the Built Environment sector, develop specialised job pathways, and improve lifelong productivity.


WELLS FARGO
THE TIMES

How will estates evolve in the future?

In order to systematically understand what capabilities will be required to drive the evolution of Smart Estates, the study started with an initial scan of sociocultural and economic trends, international case studies, emerging technology drivers, as well as contextualisation to different Smart Estate typologies.

We created **five** Smart Estate scenarios in Singapore, from different combinations of the macro-trends and drivers across the Built Environment value chain. This process allows us to peer into various future aspects of Smart Estates, taking into account the different needs of stakeholder groups involved across the Built Environment value chain, drivers of value, and business outcomes. Scenario planning further helps us uncover a range of future Smart Estate capabilities to develop, which were then validated with industry.

SOCIOCULTURAL & ECONOMIC TRENDS

- Demographic projections
- Emerging consumer demands
- New models of business and service delivery
- Policy/regulatory shifts
- Sociocultural behaviors

- Smaller and affordable homes for millennials
- Omni-channel retailing
- Experience economy
- User-centric design and design thinking
- Dependence on mobile devices
- Crowdsourcing
- Multi-modal transportation options
- Shared Economy
- Data security and privacy concerns
- Ageing population
- Customised and personalised products and services
- Multi-generational housing
- Ministry of Ageing formed to target manpower and healthcare
- Trade wars
- Rise of China

INTERNATIONAL CASE STUDIES

- Pioneering and innovative examples of smart services, products, buildings, districts, cities, innovations to surface core principles which could inspire future Smart Estates

- Centralised over-the-air software updates in Tesla products
- Customer-centric experience design at Disneyland
- Transformative retail concepts at Amazon Go
- Manufacturing and combinatorial technology at Voodoo
- Contact-free patient monitoring systems at EarlySense
- Citizens' data security concerns about Sidewalk Labs
- E-concierge guest service robots at Yotel
- Use of beacon technology at Hong Kong International Airport

TECHNOLOGY DEVELOPMENT

- Technology enablers which may drive Smart Estates management including their level of maturity, key success factors, and resource requirements to implement

- Aggregated "super" applications
- Artificial Intelligence
- Automation
- Big Data
- Cloud Computing
- Edge Computing
- Predictive Analytics
- 5G networks
- Internet-of-Things
- Digital Twin Technology
- Quantum Computers
- Advanced Robotics and Drones
- Additive Manufacturing
- Augmented and Virtual Reality
- Autonomous Vehicles
- Blockchain Technology
- Digital Biology
- 4D modeling software

SMART ESTATE TYPOLOGIES

- Education
- Sports
- Residence
- Commerce
- Business
- Industry

- Smart campuses such as Global Indian International School in Singapore and Pune, Curtin University, Manchester Metropolitan University
- Sports complexes such as Optus Stadium and Anoeta Stadium
- Smart residential estates such as Amber Park and JadeScape
- Smart retail malls such as Wanda Group's mall complexes and Westfield London
- Smart industrial or business parks such as China Fortune Smart Industrial Park, Songdo International Business District, Greenpark in Finland

SCENARIO 1: DIGITALLY-ENHANCED EXPERIENTIAL SPACES

SCENARIO 2: **VIRTUOUS FEEDBACK LOOPS FOR INTELLIGENT ESTATE DESIGN**

SCENARIO 3: **INTEGRATED CONSTRUCTION VALUE CHAINS**

SCENARIO 4: **LIVING LABS TO MAXIMISE ESTATE VALUE**

SCENARIO 5: **DYNAMIC HYPER-CONNECTED FACILITIES MANAGEMENT**

SCENARIO 1:

DIGITALLY-ENHANCED EXPERIENTIAL SPACES

Image credit: tang90246 via iStock

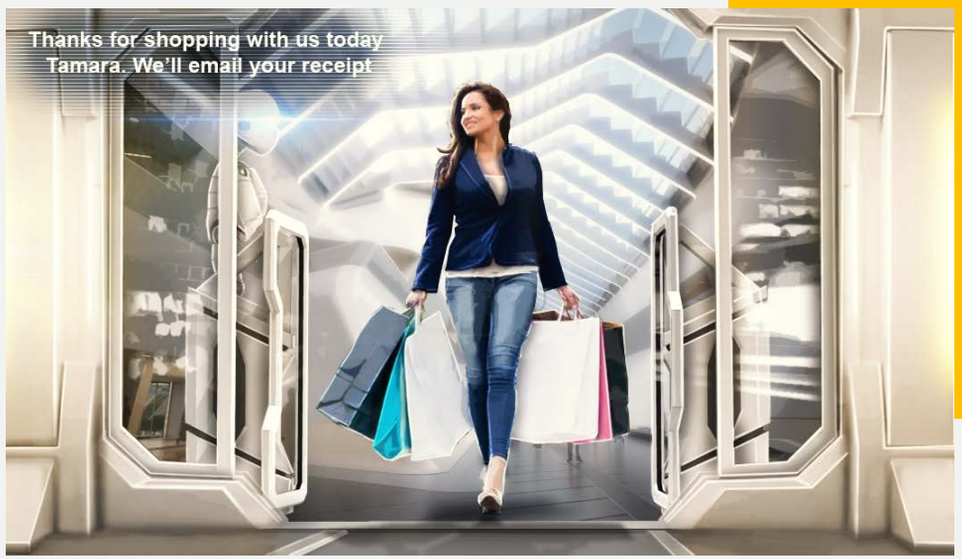
1. TRANSFORMATIVE AND CURATED ESTATE CONCEPTS

To design unique value propositions for Smart Estates, a developer scouts for emerging market and consumer trends. These are sources of inspiration for fresh estate concepts that are deeply immersive and curated for estate users, creating transformative and memorable experiences and infusing user experience design from the start.

We see a 'retail wonderland' where shoppers explore novel storefronts equipped with eye tracking software that detects a shopper's interest in a luxury leather handbag. A hologram automatically appears, showcasing the leather bag making process in France, while promoting a targeted marketing message to her. After purchasing the item through the seamless online platform, it is delivered straight to her home, customised to her favorite color and accessories.

Investing in Estate Proposition Design to create novel concepts such as integrated omni-channel shopping experiences immerses shoppers beyond even what leading brands such as Nike or Nordstrom are doing globally today.

? *What new real estate concepts can we create based on market and consumer trends and new technologies?*



2. HYPER-CONNECTED TRIBES

With the rise of remote work and co-living, individuals from different cultures cross paths with increasing frequency. Smart Estates can virtual destinations for digital natives to plug into and learn about communities aligned with their personal interests and professional needs.

Digital Community Management allows Smart Estates to tap on this trend by using intimate knowledge of the estate community to craft customised experiences for users: Organising social events, networking opportunities, craft workshops, or even wine-tasting sessions, enabling the seamless integration of living, working, and playing. An estate positioned as a dynamic community raises the project value beyond its buildings and hardware assets.

3. DESIGNING FOR DATA INSIGHTS

User insights from sensors and beacon technology can then be analysed alongside data on user profiles and purchasing history. Digital Leasing Management takes on a data-driven approach to curate a collection of tenants who would best meet shoppers' needs across different retail settings, or companies who would enhance the commercial tenant portfolio in a business park.

Users are connected to the active network, which constantly uploads data to inform AI systems of their locations. New York-based real estate crowdsourcing startup Space Jam Data is currently exploring the use of consumer and visitor activity data to gain retail insights; a concept which can be re-contextualised to the estate context.

? *Can data-driven leasing, marketing activities and strategies help maximise the value of Smart Estates?*

HOW WILL THESE TRENDS AFFECT MY BUSINESS?

The creation of meaningful experiences will be a key success metric for the Smart Estates of the future. Businesses can play a role in putting forward the enabling technology, business, and service models and gain value from:

Better Design Decisions by designing transformative user experiences in estates, putting forward innovative retail concepts. This strengthens brand identity and market position.

Space Maximisation driven by data and digital tools allows under-utilised and high potential spaces to be identified, which can translate into additional revenue generation opportunities.

Enhanced User Experience through deep integration between the physical and digital worlds create meaningful, personalised, and memorable experiences. Novelty and user satisfaction will drive footfall, revenues, and tenant retention.

Optimisation creates value for businesses as operational inefficiencies and wastage are removed through improved processes and the strategic deployment of technology solutions. Lower maintenance requirements generate cost savings in terms of manpower and materials.

WHAT ARE THE FUTURE SKILLS TO DEVELOP?

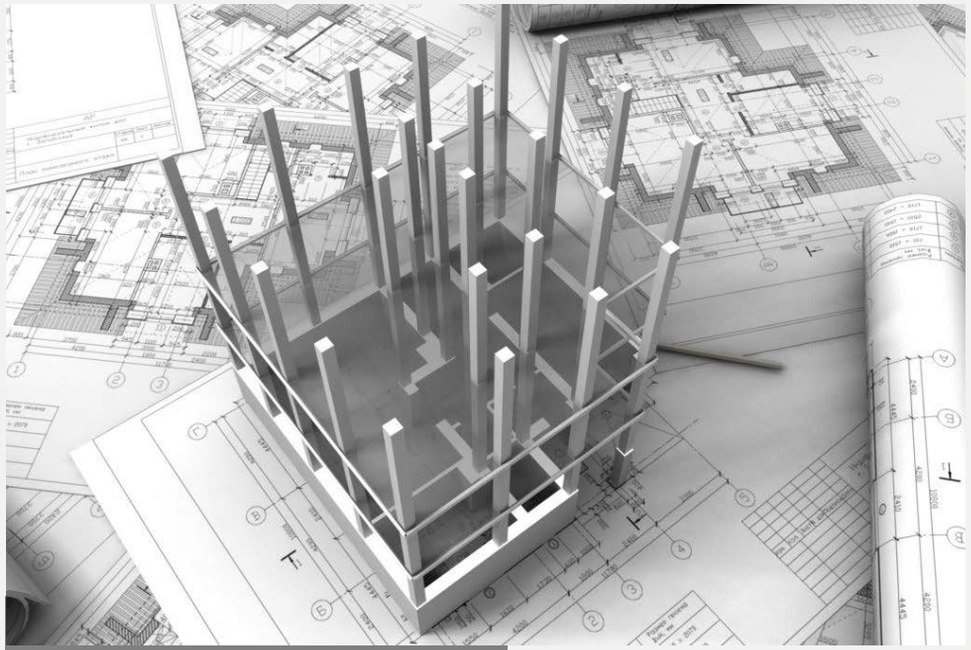
Experiences will be the currency of the future and greater efforts will have to be invested to differentiate oneself from competitors. As consumers have access to greater personalisation services, the same expectations will be placed on the Built Environment. To take advantage of this shift, businesses can take the lead to build these new capabilities:

- Events Management
- Community Engagement
- Data Analytics
- Cross-functional Facilities Management Knowledge
- Concept Planning
- Curation
- Demand Forecasting

SCENARIO 2:

VIRTUOUS FEEDBACK LOOPS FOR INTELLIGENT ESTATE DESIGN

Image credit: Chaay_Tee via iStock



1. FULL INTEGRATION OF VIRTUAL WORKFLOWS

Previously, BIM was only used until the asset handover stage. Moving forward, Smart Project Management utilizes the full potential of BIM, unleashing the collaboration, project management, procurement, and order fulfilment capabilities of the platform to form a deeply-integrated value chain across all Built Environment stakeholders. Model-based construction software enabling integrated workflows is already being developed by companies such as Finnish software firm Tekla.

With enhanced Artificial Intelligence capabilities, Smart Project Managers are now able to learn and better predict bottlenecks relating to human performance. Automated triggers are built into workflows to provide remedial action as potential delays due to vendors' inefficiencies are preemptively identified.

2. SERVICE INTEGRATION AND MANAGEMENT

With a redesigned workflow, the Smart Estate Manager manages a shared scoreboard amongst vendors across maintenance, cleaning, lifts, renovation, and security, to incentivise a collaborative culture to manage the estate effectively.

New management models for Smart Estates see tenant satisfaction levels increase and relationships with vendors improve, in addition to reducing errors and delays in service delivery.

- *What software and hardware solutions can we develop to address design challenges and improve workflows?*
- *How can we design estates which are novel, cost-effective, and create compelling physical and digital experiences?*

3. DYNAMIC VIRTUOUS FEEDBACK LOOP WITH DIGITAL TWIN

Designed with Smart Estate principles in mind, Smart Estate Solution Architecture enables Smart Estates to collect live data with Internet-of-Things (IoT) sensors built into all assets. These sensors feed into the estate's digital twin model, generating insights on maintenance issues, space utilisation patterns, and simulations to forecast building performance. Such integration is beginning to increase in adoption through platforms such as digital design and construction company Willow's software, which performs data integration, management, and analysis.

Digital Architecture, which utilises dynamic geospatial intelligence of the surrounding estate environment, generates models of traffic flows and activity patterns in different parts of the estate. This allows Digital Architects to make design decisions which are informed by the interaction of key parameters. Design scripting, supported by Artificial Intelligence applications, help achieve design breakthroughs.

Collected data can also be integrated with other buildings in the estate of the future, where Artificial Intelligence is applied to improve on subsequent designs to better suit clients' needs, maximising space while not compromising the user experience. The combined power of sensor integration and analytics will optimise building operations beyond the current capabilities of Digital Twin technology.

HOW WILL THESE TRENDS AFFECT MY BUSINESS?

Virtual collaboration and workflow integration will be key characteristics of the building and operations of future Smart Estates. These shifts will see businesses benefiting from:

Better Design Decisions from virtuous feedback loops enabled by Digital Twins will inform design parameters and considerations that are more aligned with user needs. In addition to leveraging computational design, businesses can achieve design breakthroughs which create higher value for all stakeholders.

Space Maximisation achieved through continuous data collection and analysis using Artificial Intelligence applications will also surface opportunities for additional revenue generation, such as by using underutilised spaces for activities and programming.

Automated Management Processes allow businesses to enjoy time and manpower savings, while also allowing talent to transition into more productive and value adding roles as they grow their careers.

Optimisation of workflows will bring cost savings to businesses as error are minimised, risk is better managed, and open collaboration and communication on integrated digital platforms supports timely project delivery.

WHAT ARE THE FUTURE SKILLS TO DEVELOP?

Businesses must adapt to the increasing virtualisation of workflows and processes to stay ahead of the curve. This requires greater investment in capabilities such as:

- Digital Twins
- Geographic Information Systems
- Parametric Modelling
- Computational Design
- Simulation Modelling
- Algorithm Building
- Building Information Modeling (BIM)
- Artificial Intelligence
- Design Scripting

SCENARIO 3:

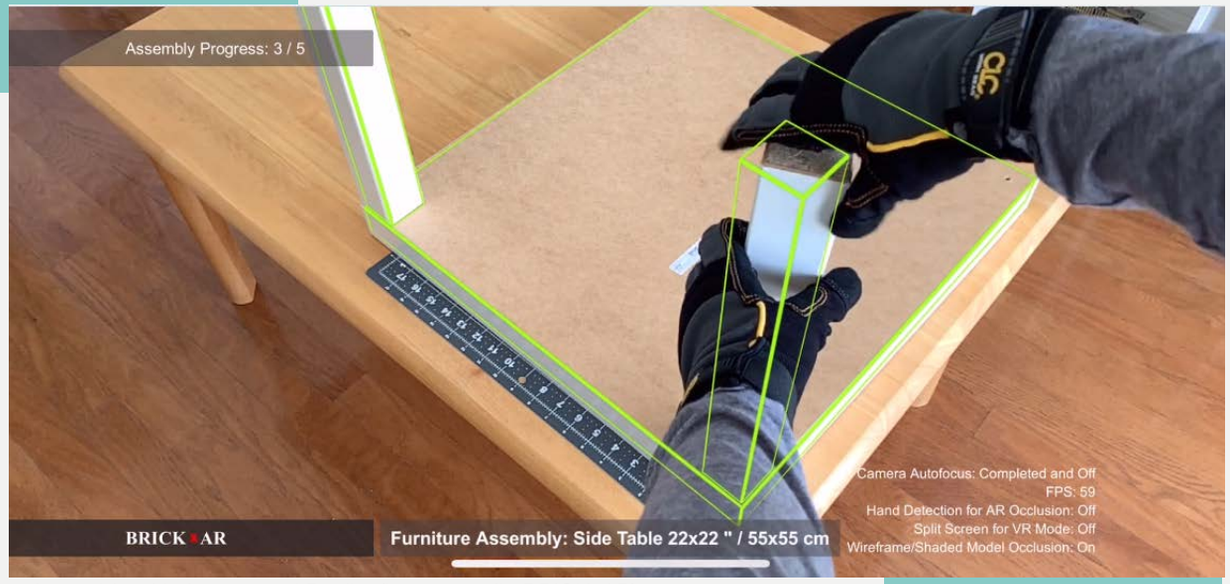
INTEGRATED CONSTRUCTION VALUE CHAINS

Image credit: gorodenkoff via iStock

1. BESPOKE FACILIITES TO MEET COMPLEX USER NEEDS

An elderly resident with Alzheimer's disease occasionally leaves the stove turned on or forgets to switch off her TV. Thankfully, her smart home has been designed with Digital Architecture capabilities, which have considered how her home environment might utilize IoT sensors to trigger automatic follow-up actions when there is an abnormal use of home appliance. This is similar to the alerts triggered by Evermind or QuietCare sensors, which track daily routines and inform loved ones of unusual user behavior to watch out for, and will be a design consideration of increasing importance to cater to the needs of the growing elderly population in Singapore.

Another wheelchair-bound resident from the floor above had his home built with wheelchair accessibility in mind. This is an example of homes that are now enabled by digital construction technologies, mass-customised home furnishings, and visualised with immersive, rapidly-rendered 3D modelling.



Assembly with Augmented Reality (Image credit: BRICKxAR)

2. VIRTUAL AND AUGMENTED REALITY-BASED TROUBLESHOOTING

On-site construction workers improve productivity by using VR/AR goggles to visualise the exact site fittings according to the visual model designed. With 5G connectivity, construction teams can receive live remote guidance for immediate support and resolution of any construction and technical issues from the Smart Project Manager or other technical specialists. This allows them to minimise mistakes and avoid costly rework, while seamlessly integrating the phases of building construction and maintenance. India-based Larsen & Toubro uses VR technology to train their workers to create virtual reproductions of real-life scenarios, increasing safety awareness by 90 percent and improving the accessibility of training seven-fold.

3. DRONES FOR INSPECTION AND MANAGEMENT

Smart Project Management heavily leverages on drone deployment to collect real-time data, especially in inaccessible sites, track the progress of the construction process, and performs safety monitoring tasks across several large-scale projects which are ongoing within the estate. Construction teams are now equipped with high-resolution images and site maps of the full estate premises to instantly deliver updates to all project stakeholders.

Transparent communication, enabled by drone utilisation and operation, improves collaboration and saves valuable project resources. A two to three-week process can be cut down to one to four days, ensuring timely and efficient project delivery.

? *How can we manage the complex collaboration process between multiple stakeholders for successful integrated delivery?*

HOW WILL THESE TRENDS AFFECT MY BUSINESS?

Integrated construction processes leveraging virtual collaboration tools and remote-monitoring technology will fundamentally change how estates are constructed. Businesses can derive great value from this shift with:

Mass Customisation offers businesses an opportunity to command a premium in their brand and service offerings, by tailoring solutions to meet the unique requirements of different clients. Current technology significantly reduces the cost of customisation, creating a strong business case for its use.

Optimisation ensures that businesses minimise wastage from delays or process inefficiencies, and benefit from increased productivity. The use of technology tools reduces inefficiencies across multi-stakeholder workflows, and removes additional time costs and potential penalties due to untimely project delivery.

Better Design Decisions which are aligned with user needs, and create integrated physical and digital experiences, will see increased demand from buyers. This improves asset quality and therefore asset market value.

WHAT ARE THE FUTURE SKILLS TO DEVELOP?

Technology disruptions and expanding business portfolios are an opportunity for businesses to differentiate themselves and meet client and user needs creatively. Future Smart Estates will require businesses to have these capabilities:

- 3D Modelling
- Simulation Modelling
- User-Centric Design
- Digital Tools for Project Management
- Machine Vision
- Video Analytics
- Data Analytics and Diagnostic
- Systems Integration

SCENARIO 4:

LIVING LABS FOR MAXIMISED ESTATE VALUE

Image credit: sinology via iStock

1. NEW JOURNEYS TO WORK

To identify opportunities to enhance estate value, Digital Asset Strategy will involve understanding emerging trends such as the rise of multi-modal transport journeys that could present an additional revenue stream for the Smart Estate.

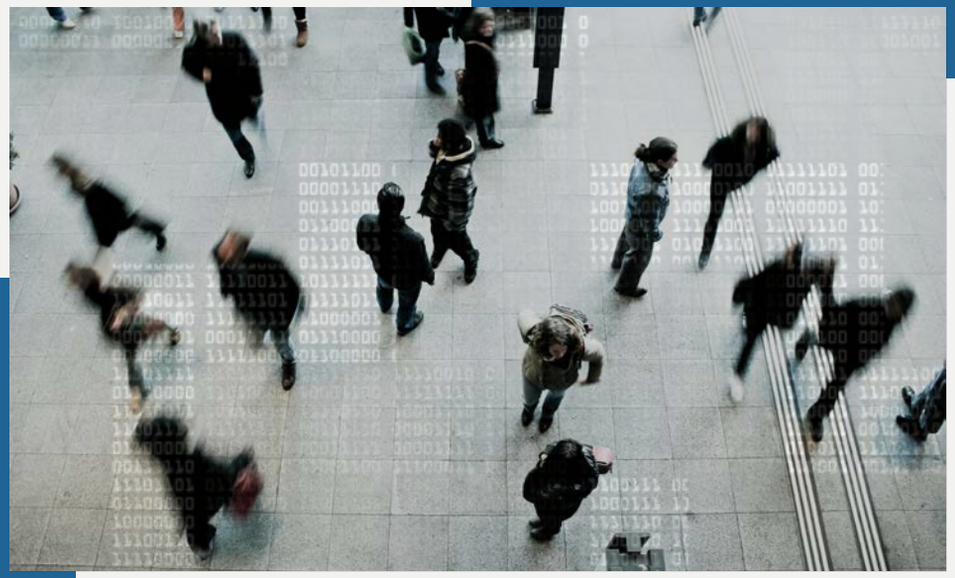
For example, shared spaces are designed where bicycle-sharing riders can park their vehicles, informed by optimised routes from their homes into vacant parking spaces within the business park, which has dynamically reconfigurable parking lines to maximise lot sizes – bringing a potential commercial application for the Smart Highways and dynamic lanes as introduced by Heijmans Infrastructure and Studio Roosegaarde in the Netherlands.

The Smart Estate Manager utilises user activity generated from mobile data to inform infrastructure installation sites such as charging and docking points for EVs, to support a more sustainable lifestyle for users.

? *How can we leverage data across the Built Environment value chain, to optimise the positioning and value of estates?*

2. CENTRALISED SOFTWARE UPGRADES

In executing the Digital Asset Strategy, Smart Estate Solution Architecture capabilities would come in to develop and facilitate the adoption of various technologies such as IoT sensors, which have software upgrades that conveniently update centrally and automatically, as inspired by Tesla's centralised wireless upgrading system for its cars and vehicles. Residential or commercial estate users pay a premium to access these benefits which value-add to their homes and office spaces, without having to worry about the technologies going obsolete. This greatly enhances the occupant experience of the estate.

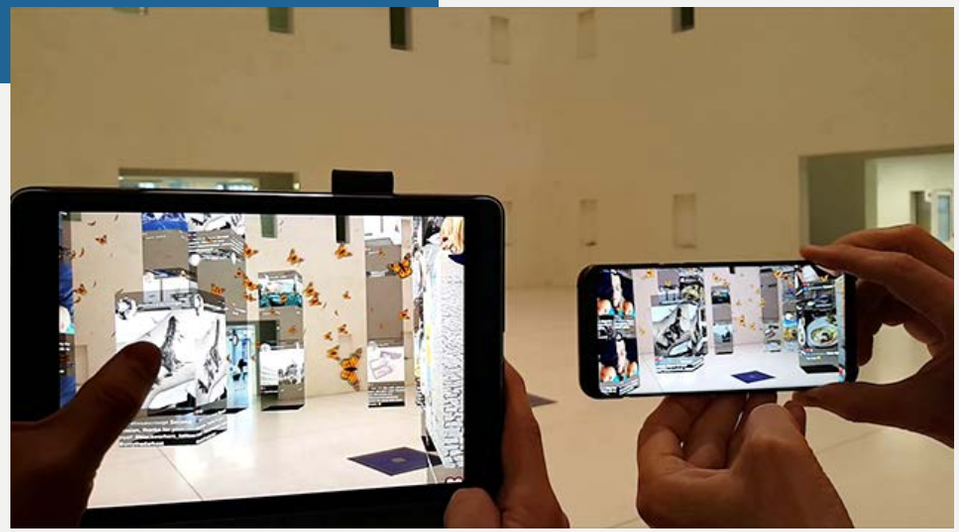


3. EXPERIMENTAL SPACES

Bridging between online and physical communities, Digital Community Management now utilises crowdsourced indoor positioning data in a business or science park at different hours of the day to highlight public events and other users available for collaborative discussions or meetings in under-utilised spaces around the property. This further strengthens the sense of place within the estate. The under-utilised spaces may also be transformed into testbeds in retail environments to help entrepreneurs obtain feedback on their prototypes or newly-launched products, and keeping the retail mix diverse, exciting, and refreshing. Pop-up space 'The Edit' is already beginning to offer such a space for e-commerce startups in malls in the United States.

4. EXPERIENCE-ORIENTED DIGITAL DESIGN

Augmented reality powers rich learning and leisure experiences tailored to the multitude of estate users' interests. The Digital Asset Strategist proposes a greater emphasis on digital placemaking to increase footfall in the estate, informed by an analysis of the estate user demographics. In seconds, a student or frequent commuter creates incidental moments of learning based on the natural and Built Environment. Placemaking activities include the combination of heritage and digital technologies to enhance user experiences, much like mobile application design firm Calvium's Battersea Power Station Heritage Trail guide, which bridges between the physical and digital realms.



? *How can we improve the estate experience to better engage and innovatively fulfill the needs of the community?*

HOW WILL THESE TRENDS AFFECT MY BUSINESS?

Digital immersion and connectivity are at the core of the Smart Estates of the future. Businesses have a tremendous opportunity to take advantage of these trends, which can add value through:

Space Maximisation by activating spaces using digital tools and creative programming allows paves the way towards additional revenue streams.

Optimisation using data sources and artificial intelligence tools can bring costs down by intelligently managing business resources such as manpower, time, and energy.

Enhanced User Experiences can be achieved through digital and physical integration. The increased memorability of spaces and level of user satisfaction through better designed spaces enhances brand and price premium, while achieving greater differentiation.

WHAT ARE THE FUTURE SKILLS TO DEVELOP?

Businesses today are already experiencing a shift in customer expectations and increased competition, which demands rapid innovation to bring novel and value-adding products and services to the market. To succeed, businesses should invest in growing their capabilities in:

- Digital Scanning
- 3D Modelling
- Digital Platforms and Technology Knowledge
- Heritage and Historical Knowledge
- Events Planning
- User-Centric Design
- Data Visualisation
- UX Interfacing

Image credit: metamorworks via iStock

SCENARIO 5:

DYNAMIC & HYPER-CONNECTED FACILITIES MANAGEMENT

1. REMOTE MONITORING AND CENTRALISED DEPLOYMENT

Instead of managing estates individually, Smart Estate Management centralizes management capabilities at command centres where remote monitoring can take place and support can be deployed by-exception. Alerts are triggered due to loitering or sudden movements picked up by the machine vision system on premise, and security personnel is deployed on-site to address the threat. Autonomous cleaning robots and vehicles are systematically deployed once an incident is detected. Chye Thiam Maintenance has operationalised such as model using live video feeds at their command centre to augment static patrolling schedules and control monitoring costs. Applied across the Smart Estate, this model generates economies of scale as multiple properties leverage the analytical capabilities of a single centralised management facility.

2. JOB INTEGRATION

As the use of autonomous technology proliferates to respond to manpower constraints, Smart Estate Management now involves the deployment of cleaning supervisors who have developed an understanding of how to perform basic technical troubleshooting for autonomous cleaning robot malfunctions. Concurrently, the security personnel's routine tasks expand to include building inspection, basic maintenance and fixes, and data analytics for incident reporting. This approach is already being explored at Certis in their Security+ offering, which combines security with facilities management, customer service, and technology-driven solutions.

Autonomous cleaning robots deployed in Singapore

3. INPUTS TO OUTCOMES AND PERFORMANCE-BASED CONTRACTS

Automation and technology innovation allows estate service providers to adopt outcomes-based and performance-based contracts, which are seamlessly managed on digital platforms for multiple properties by the Smart Estate Manager. Firms are now able to invest in technologies such as video analytics and machine vision to maximise user satisfaction with a reduced headcount. Robotic cleaners, accompanied by human supervisors who monitor the robots and perform finishing touches, ensure higher manpower productivity at lower long-term costs.

Smart Command system for water use monitoring (Image credit: Caroma Industries)

4. PREDICTIVE ANALYTICS

Estates are equipped with predictive analytics capabilities to support decision-making, so as to more effectively allocate estate resources. Toilets are thoughtfully-designed for efficient cleaning, and equipped with IoT sensors to track the usage of supplies, water, waste, and user satisfaction. These in turn inform on the effectiveness of estate-wide sustainability strategies, as part of Smart Sustainability Management.

Security staff and analysts at the central command center combine video analytics, machine vision, and behavioral analysis techniques to identify suspicious behavior on the physical estate premises as well as online data platforms. Logs of usual and abnormal behavior are analysed to proactively identify cyber-physical system vulnerabilities and analyse potential breaches.

?

- *Which new estate management models can support the operations of responsive and dynamic Smart Estates?*
- *How can we enhance the sustainability of our estate operations?*

HOW WILL THESE TRENDS AFFECT MY BUSINESS?

Smart Estates present an exciting opportunity for businesses to explore and enhance business and operating models, such as the centralised deployment of cyber-physical security or use of full autonomous robots, which are no longer a distant reality. This can bring some of the following benefits to businesses:

Outcomes-based Contracts spur R&D investments to innovate and improve service delivery, which can increase client satisfaction and retention whilst reducing operating costs.

Automated Management Processes can bring productivity increases as automated processes efficiently clear administrative matters.

Robotisation enables businesses to reduce operating costs and increase productivity at scale, creating an opportunity to upskill other staff into higher value-adding activities.

Job Integration promises staff satisfaction and career growth for current staff members, while the synergies derived from combined business functions under reduced headcount keeps operating costs in check.

WHAT ARE THE FUTURE SKILLS TO DEVELOP?

As these future trends collide with present business challenges, such as rising customer expectations and a growing asset portfolio, businesses will succeed by investing in building the following capabilities early on:

- Basic Robotics Operations
- Data & Statistical Analytics
- Security & Risk Management
- Systems Integration
- Robot Programming
- Machine Learning
- Algorithm Development
- Systems Integration
- Digital Twinning
- Asset Condition Monitoring
- IoT Integration and Installation
- Sensor Interfacing

Image credit: metamorworks via iStock

Future Jobs and Skills for Smart Estates

Image credit: metamorworks via iStock

What future job roles should businesses invest in?

This section demonstrates an initial set of emerging job roles that firms can use as a reference to support their Smart Estates talent needs. As the respective government agencies continue to work with more industry and best-in-class players, it will be an ongoing process to grow and refine this base of job roles and skills insights.

DESIGN & DEVELOPMENT

CONSTRUCTION

ESTATE PROPOSITION DESIGNER

Creates innovative real estate concepts and value propositions for future developments

DIGITAL DESIGNER

Designs Smart Estate buildings with virtual modelling and integrates design with the construction stage, ensuring its delivery success

SMART ESTATE SOLUTION ARCHITECT

Manages technical teams and the end-to-end lifecycle of technical solutions to facilitate dynamic estate operations

SMART PROJECT MANAGER

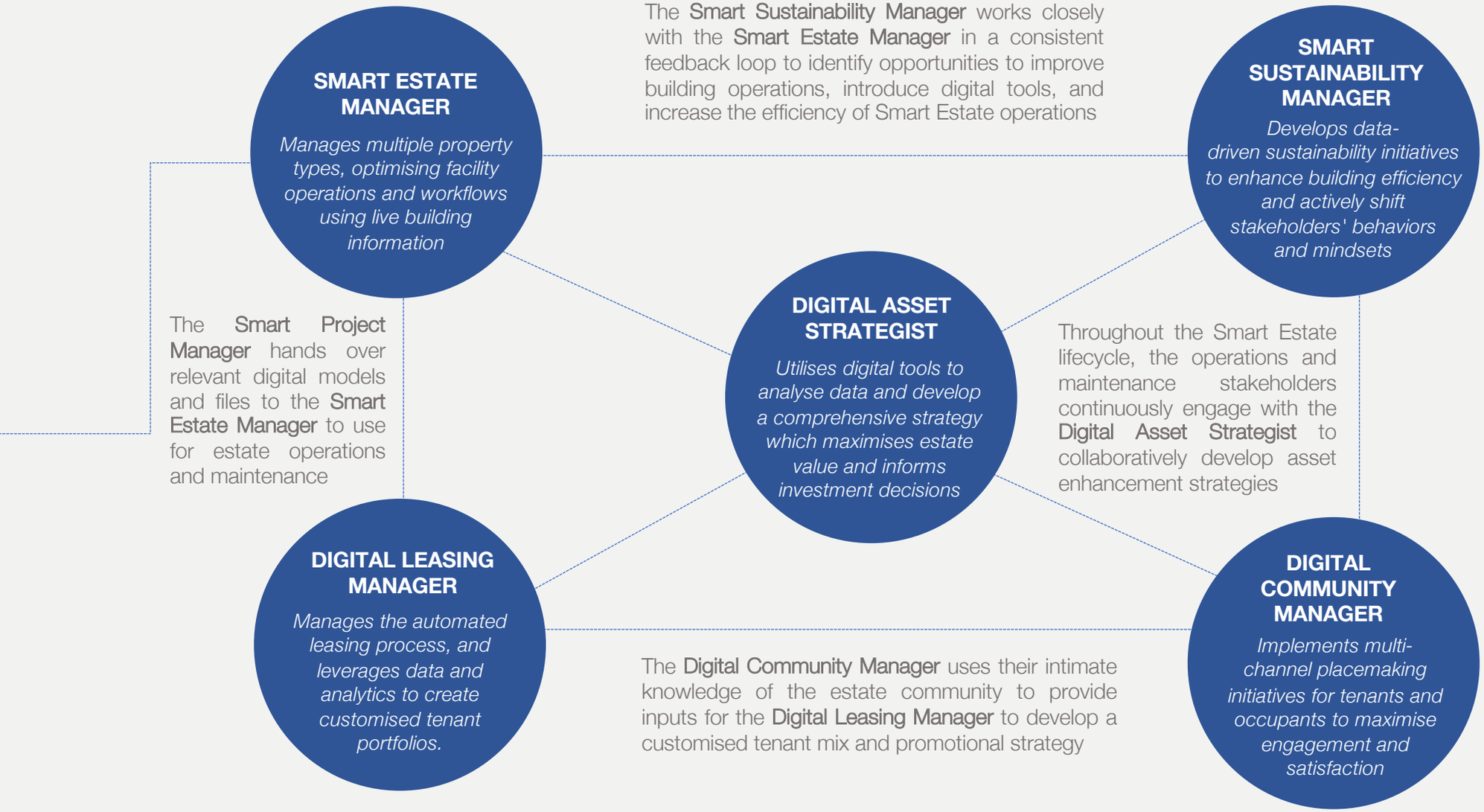
Oversees the execution and implementation of Smart Estate projects

The **Estate Proposition Designer**'s value proposition is built upon by the **Digital Designer** to co-create innovative building designs for Smart Estates with clients

The **Digital Designer** develops conceptual designs and identifies technical needs, which form the solution parameters the **Smart Estate Solution Architect** to design around

The **Smart Project Manager**, engages with the **Digital Designer** and the **Smart Estate Solution Architect** throughout the Integrated Digital Delivery (IDD) process

OPERATIONS & SMART FACILITIES MANAGEMENT



The Estate Proposition Designer creates innovative real estate concepts and value propositions for future developments.

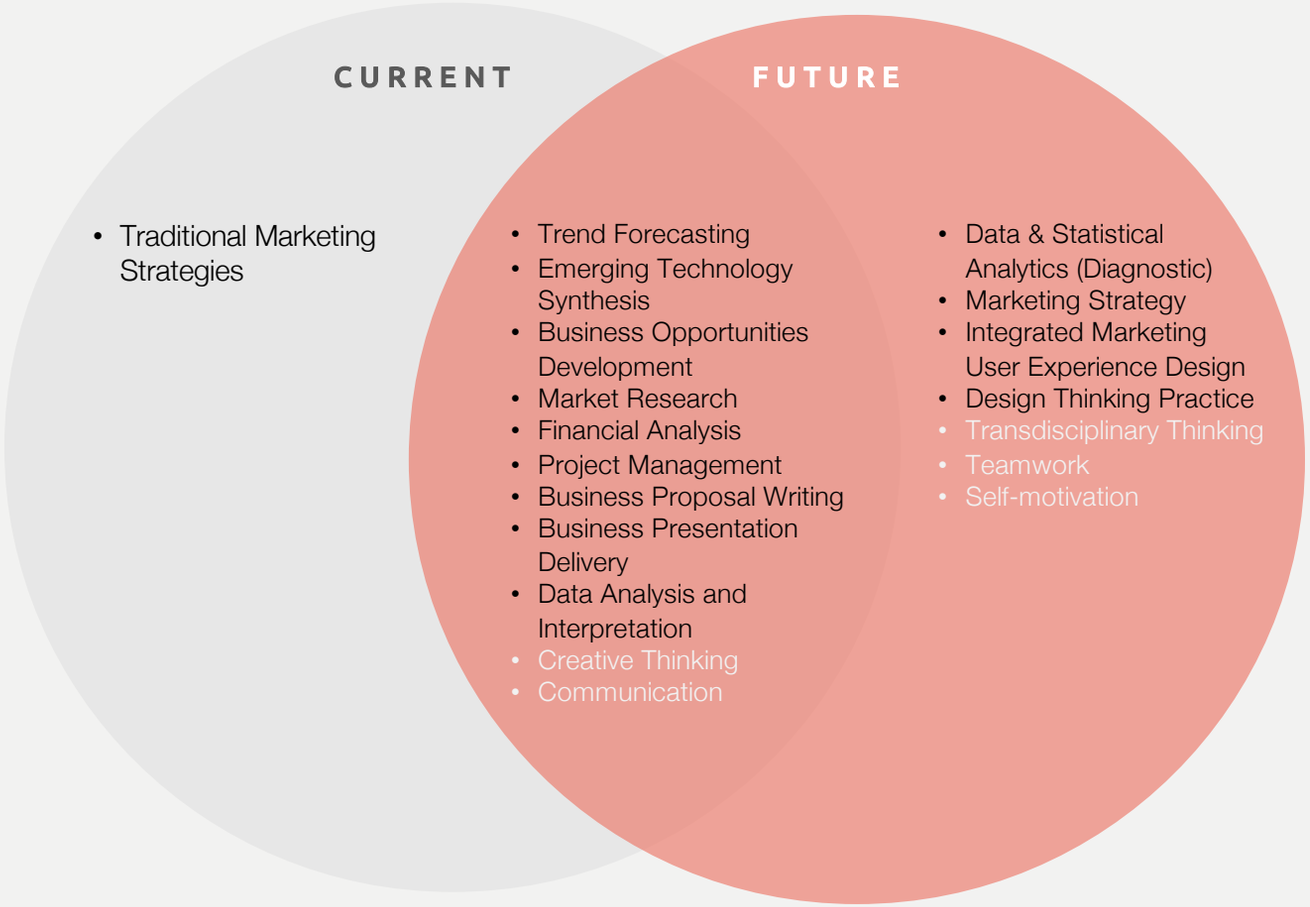
KEY RESPONSIBILITIES

- Integrate real estate domain knowledge with Smart Estate principles (e.g. IoT sensors to improve responsiveness of estate, rising consumer interest in local brands/social enterprises affecting investments)
- Use technology for Built Environment and consumer trends to innovate around property development concepts (e.g. Experiential retail at Funan, millennial co-living at Lyf)
- Apply experience design principles for the Built Environment to plan transformational estate experience for tenants and occupants
- Support new value proposition design and fresh property development concepts with a compelling business case and financing model

The Estate Proposition Designer is a role that current Business Development Executives have the foundational skillsets to pursue

KEY COMPETENCIES

LEGEND: TECHNICAL SKILLS GENERIC SKILLS



WHO ELSE CAN TRANSITION INTO THIS ROLE?

ASSET MANAGER
Monitors property performance and develops initiatives to maximise property revenue, with a focus on financial performance

The Digital Designer creates Smart Estate buildings with virtual modelling and integrates design with construction stage, ensuring its delivery success.

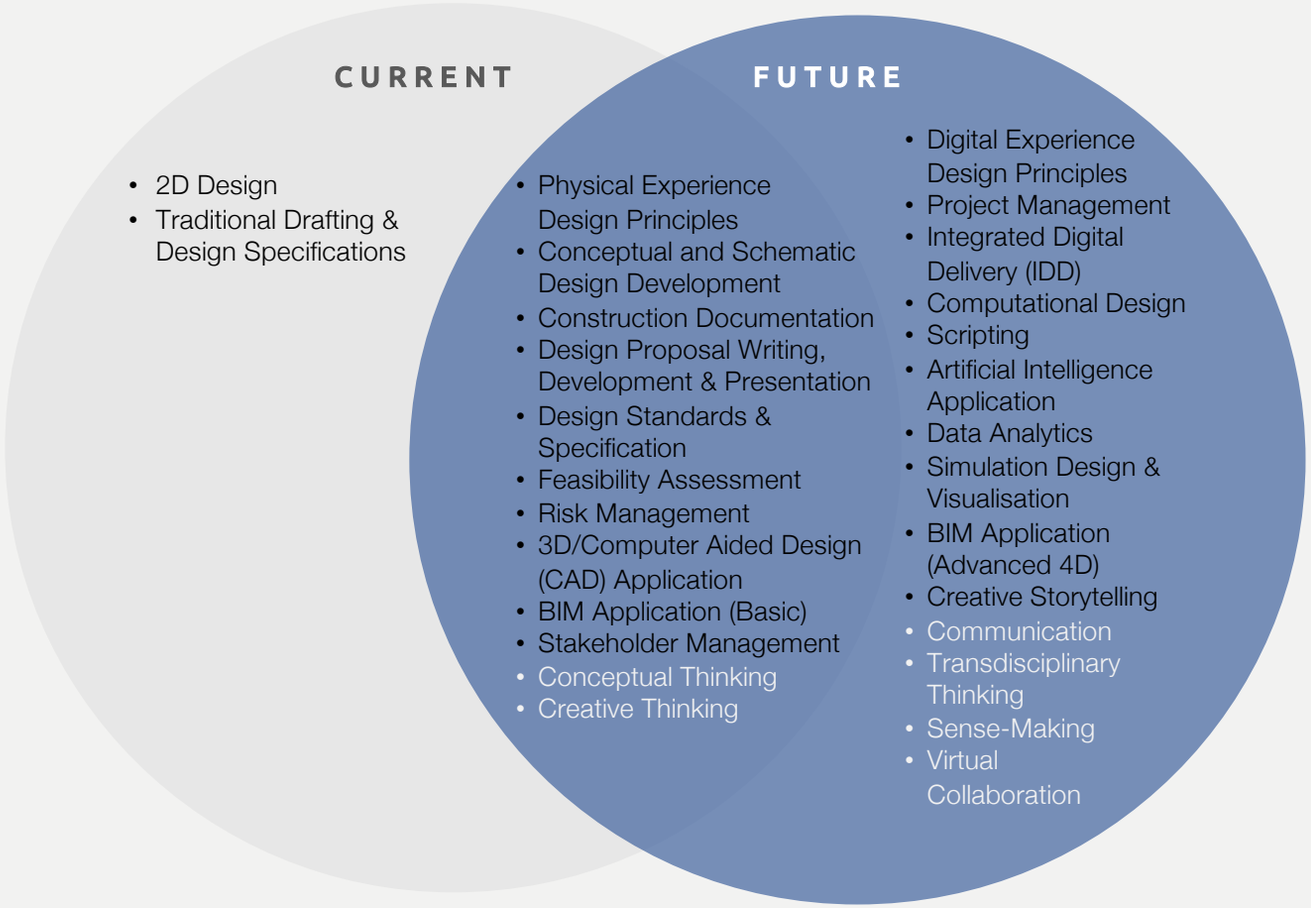
KEY RESPONSIBILITIES

- Integrate architectural domain knowledge with Smart Estate principles (e.g. IoT sensors to improve responsiveness of estate, building design to allow estate to enhance its dynamism)
- Use Computational Design to incorporate multiple design factors and considerations from stakeholders for Integrated Digital Delivery (IDD), including running simulations and responsive virtual models, analyzing data, and optimising resources
- Use scripting and Artificial Intelligence to achieve greater design outcomes such as sophisticated geometry and biomimetic design
- Apply experience design principles early on in designing the buildings to plan transformational physical and digital estate experiences for users
- Support integration of design into the construction stage to prevent additional rework
- Enhance creativity of design offerings by driving collaborations with experts across disciplines (e.g. social anthropologist to improve office building design based on human interaction patterns)

The Digital Designer role is a potential career development pathway for current Architectural Assistants and Urban Designers to consider

KEY COMPETENCIES

LEGEND: TECHNICAL SKILLS GENERIC SKILLS



WHO ELSE CAN TRANSITION INTO THIS ROLE?

BIM DESIGNER
Uses Building Information Modelling (BIM) software to prepare 3D architectural, structural, or shop drawings for construction

The Smart Estate Solution Architect manages technical teams and the end-to-end lifecycle of technical solutions to facilitate dynamic estate operations.

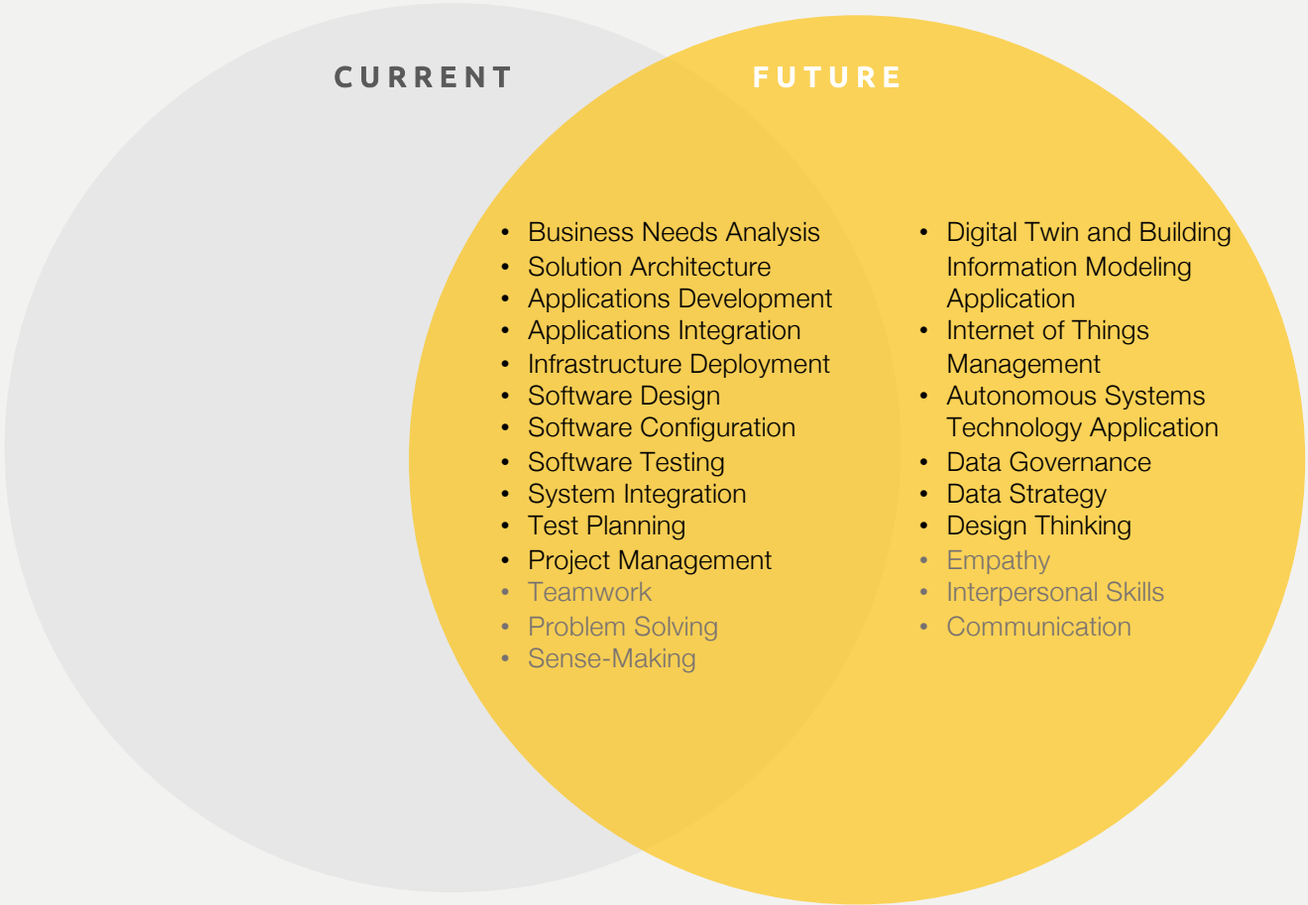
KEY RESPONSIBILITIES

- Design complex, customised, integrated software and hardware solution specific to address Built Environment challenges and improve workflows/processes (e.g. lightweight Digital Twin to operationalise BIM, interoperable IoT system for predictive FM)
- Manage technical teams and oversee the implementation of technology-based solutions
- Develop data governance architecture for the use of Digital Twins, BIM, or other technology solutions for relevant stakeholders
- Develop business case and financing model for technology solutions

The Smart Estate Solution Architect is a suitable role for current IT Solution Architects to grow into

KEY COMPETENCIES

LEGEND: TECHNICAL SKILLS GENERIC SKILLS



WHO ELSE CAN TRANSITION INTO THIS ROLE?

SYSTEMS ANALYST

Assesses clients' technology needs and develops technical specifications for systems-level solutions to fulfill business requirements

The Smart Project Manager oversees the execution and implementation of Smart Estate projects.

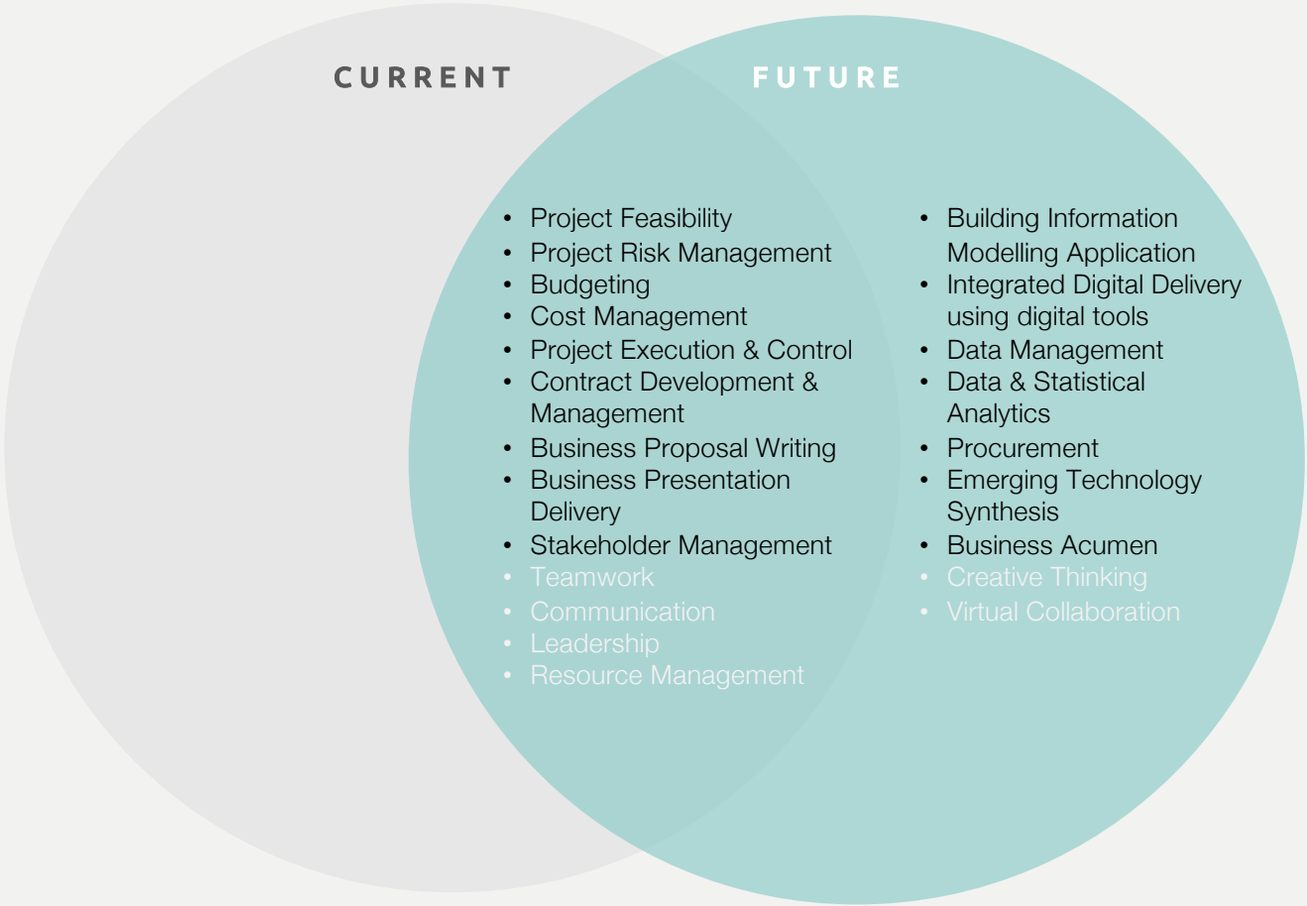
KEY RESPONSIBILITIES

- Oversee successful execution and implementation of digital technologies into Built Environment projects, including procurement processes for technical project elements (e.g. Facial recognition equipment for access control)
- Manage Integrated Digital Delivery process and coordination amongst stakeholders (e.g. construction firm, internal teams, architects)
- Estimate and model project costs, time, and resource requirements and potential risks using digital management tools
- Resolve technical and design-related issues in project implementation and ensure compliance with project design requirements
- Monitor project progress and ensure effective handover of BIM or other digital collaboration tools used

Project Managers can grow in their profession by acquiring a full set of skills to become effective Smart Project Managers for Smart Estates

KEY COMPETENCIES

LEGEND: ● TECHNICAL SKILLS ○ GENERIC SKILLS



WHO ELSE CAN TRANSITION INTO THIS ROLE?

QUANTITY SURVEYOR

Responsible for the project's cost, budget and quality from pre-planning, tendering and procurement, to contracts and completion.

The Smart Estate Manager manages multiple property types, optimising facility operations and workflows using live building information.

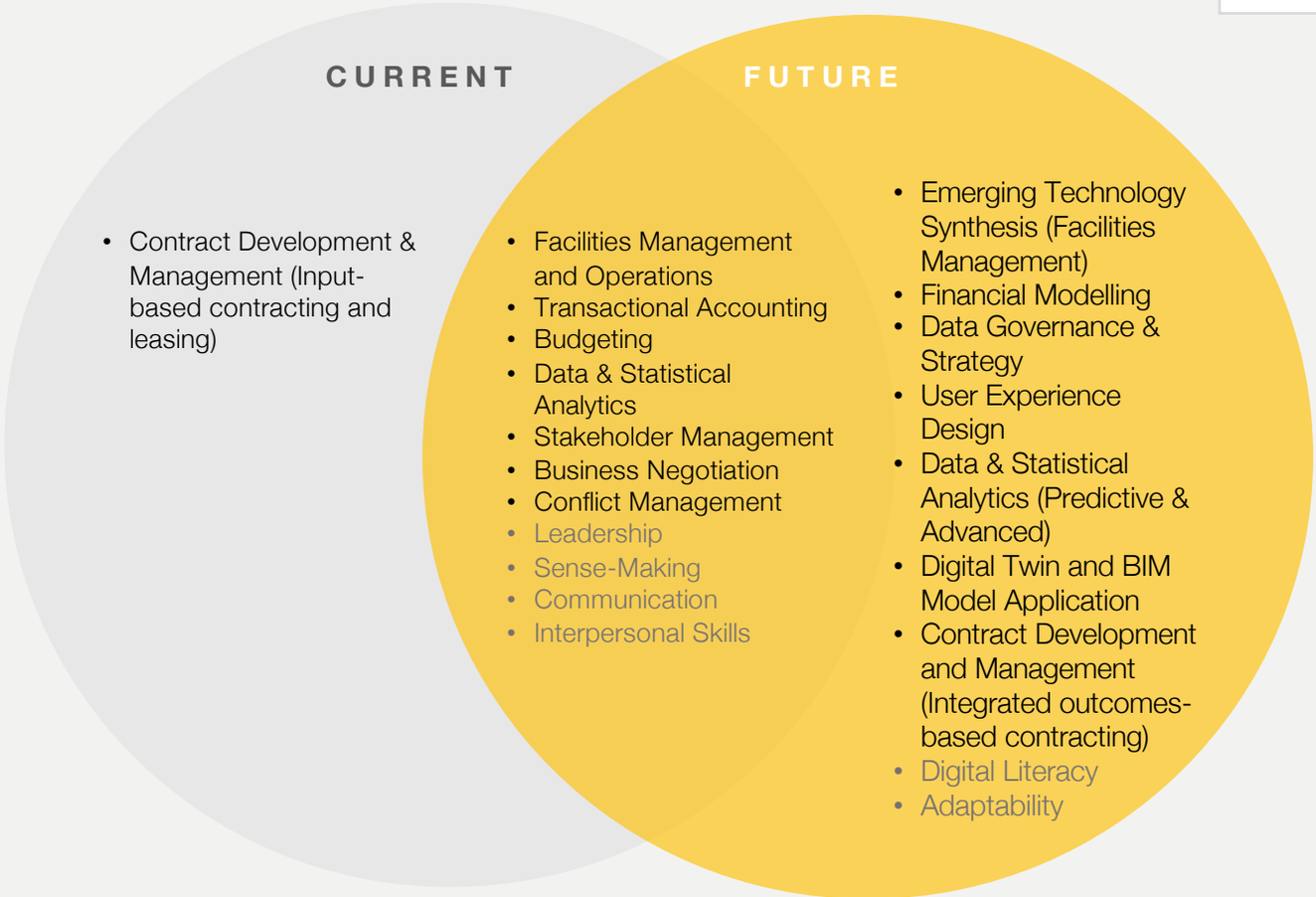
KEY RESPONSIBILITIES

- Identify facilities management technology use cases that can reduce manpower costs, improve efficiency, and productivity (e.g. automated cleaning robots, building inspection drones, smart toilets)
- Enhance and optimise facility management operations using digital platforms (e.g. Digital Twin or BIM models to track building performance, asset conditions, and maintenance work statuses)
- Develop and enforce data governance to secure privacy and enable seamless data usage (e.g. Data usage principles and handover protocols for vendors)
- Improve customer experience with data analytics (e.g. Collecting data from IoT sensors on asset conditions and using predictive analytics to anticipate facility breakdowns)
- Handle customer/vendor cases by exception with integrated outcomes-based contracts across multiple properties (e.g. Mobile application to automate request processing, track feedback, and contact vendors)

Property and Building Managers overseeing property operations are well-positioned to acquire new skills to become Smart Estate Managers

KEY COMPETENCIES

LEGEND: TECHNICAL SKILLS GENERIC SKILLS



WHO ELSE CAN TRANSITION INTO THIS ROLE?

FACILITIES MANAGER
Manages and maintains property facilities through coordination of maintenance activities and programmes (e.g. inspections, repairs)

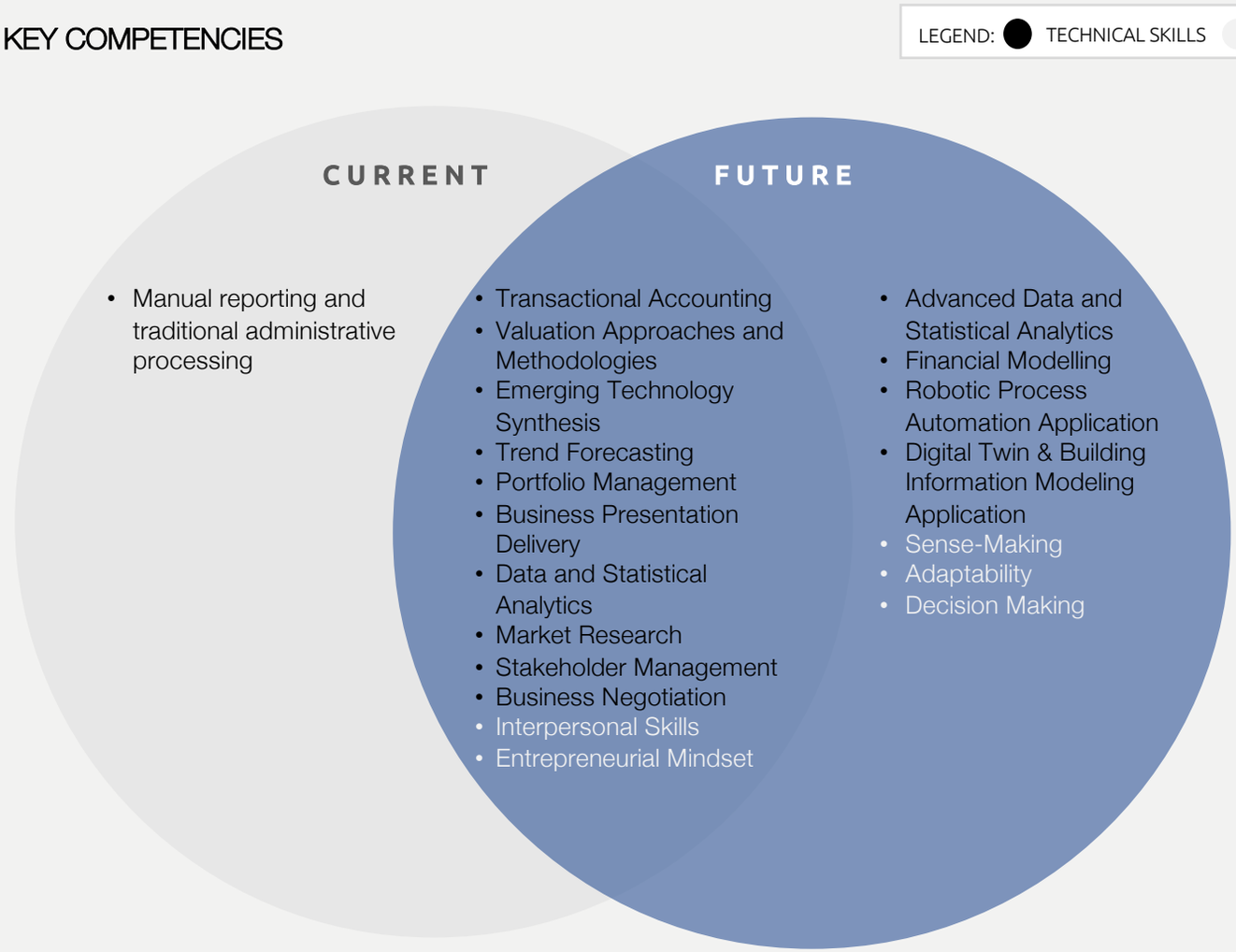
The Digital Leasing Manager manages the automated leasing process, and leverages data and analytics to create customised tenant portfolios.

KEY RESPONSIBILITIES

- Identify opportunities to redevelop and enhance contracts, keeping in view recent trends, research, political, financial, and economic news
- Use Robotic Process Automation (RPA) to improve and automate administrative processes to achieve seamless operations (e.g. onboarding process for contracting and leasing; automated agreements for rapid compliance; monthly reporting to management)
- Use analytics and data mining to offer good proposals to potential tenants with contracts that suit their needs
- Structure and negotiate contracts with tenants, which continuously improve to remain attractive, provides flexibility, reduce vacancies and limits liability through lease analysis

Today's Leasing Managers have a strong set of core skills that will allow them to transition smoothly into the role of a Digital Leasing Manager

KEY COMPETENCIES



WHO ELSE CAN TRANSITION INTO THIS ROLE?

RELATIONSHIP/ ACCOUNT MANAGER

Build strong relationships with clients, address tenant or occupant concerns and identify enhancement opportunities

The Digital Asset Strategist utilises digital tools to analyse data and develop a comprehensive strategy which maximises estate value and informs investment decisions.

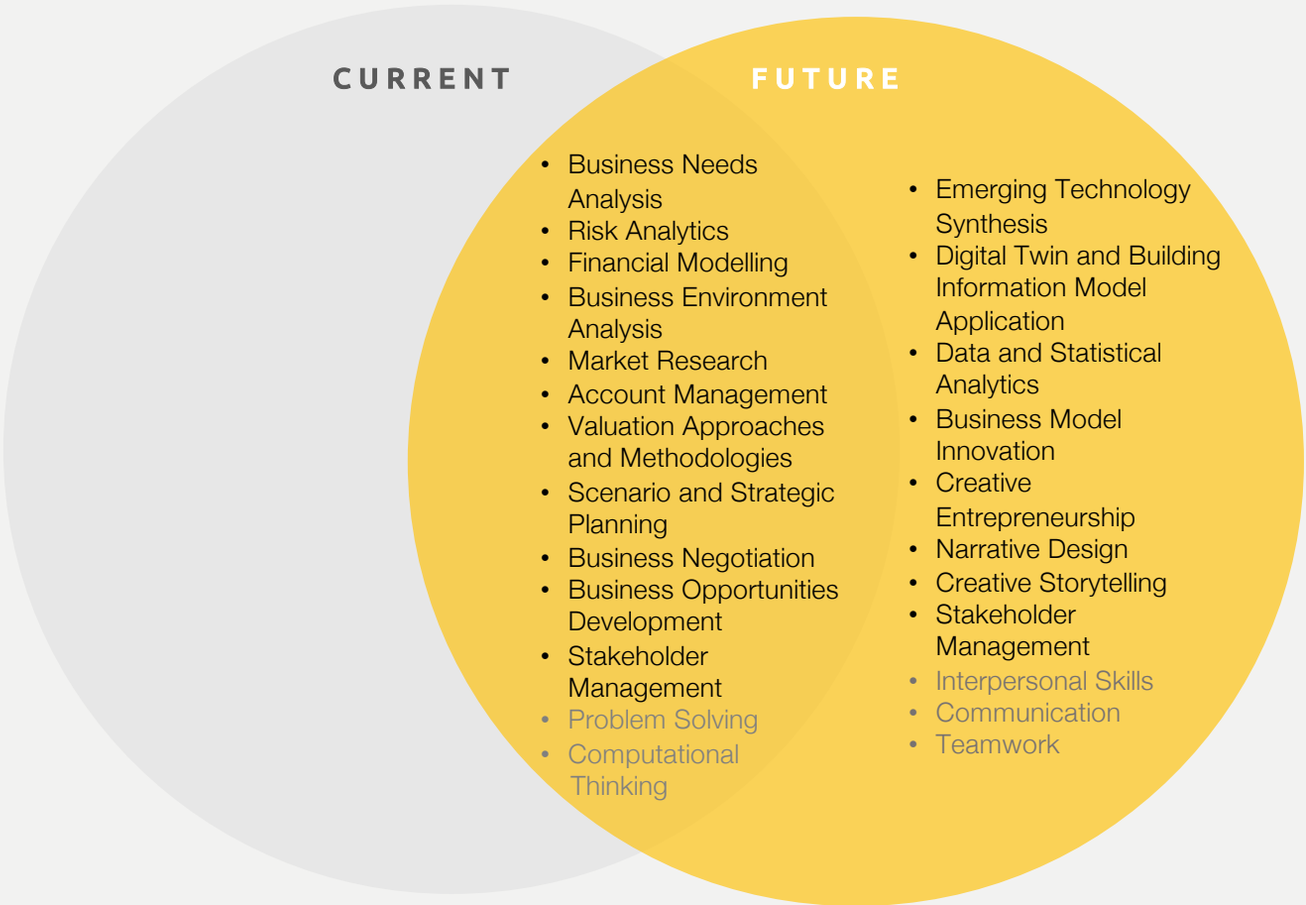
KEY RESPONSIBILITIES

- Make optimal investment decisions aligned with emerging market trends and forecasts in the Built Environment sector, including the ability to scan, evaluate, and adopt technologies to enhance assets
- Harness and analyse data from the use of BIM for facilities management and other estate data insights to improve estate performance
- Develop innovative business models and financial models to expand project financing options or assess impact of potential revenue-enhancing activities in estates
- Collaborate and co-create with relevant stakeholders including Smart Estate Manager, Digital Leasing Manager, Digital Community Manager, and clients to manage asset revenues and costs to develop the estate's market positioning and enhance asset performance, increasing attractiveness for new and existing tenants
- Articulate value of investment and portfolio diversification strategies to internal and external stakeholders, with data-driven decisions

Asset Managers can acquire new skills to develop into Digital Asset Strategists to drive businesses forward

KEY COMPETENCIES

LEGEND: TECHNICAL SKILLS GENERIC SKILLS



WHO ELSE CAN TRANSITION INTO THIS ROLE?

INVESTMENT & DEVELOPMENT EXECUTIVE

Strategise real estate investments, developments, and divestments based on financial models and analysis of market drivers

The Smart Sustainability Manager develops data-driven sustainability initiatives to enhance building efficiency and actively shift stakeholders' behaviors and mindsets.

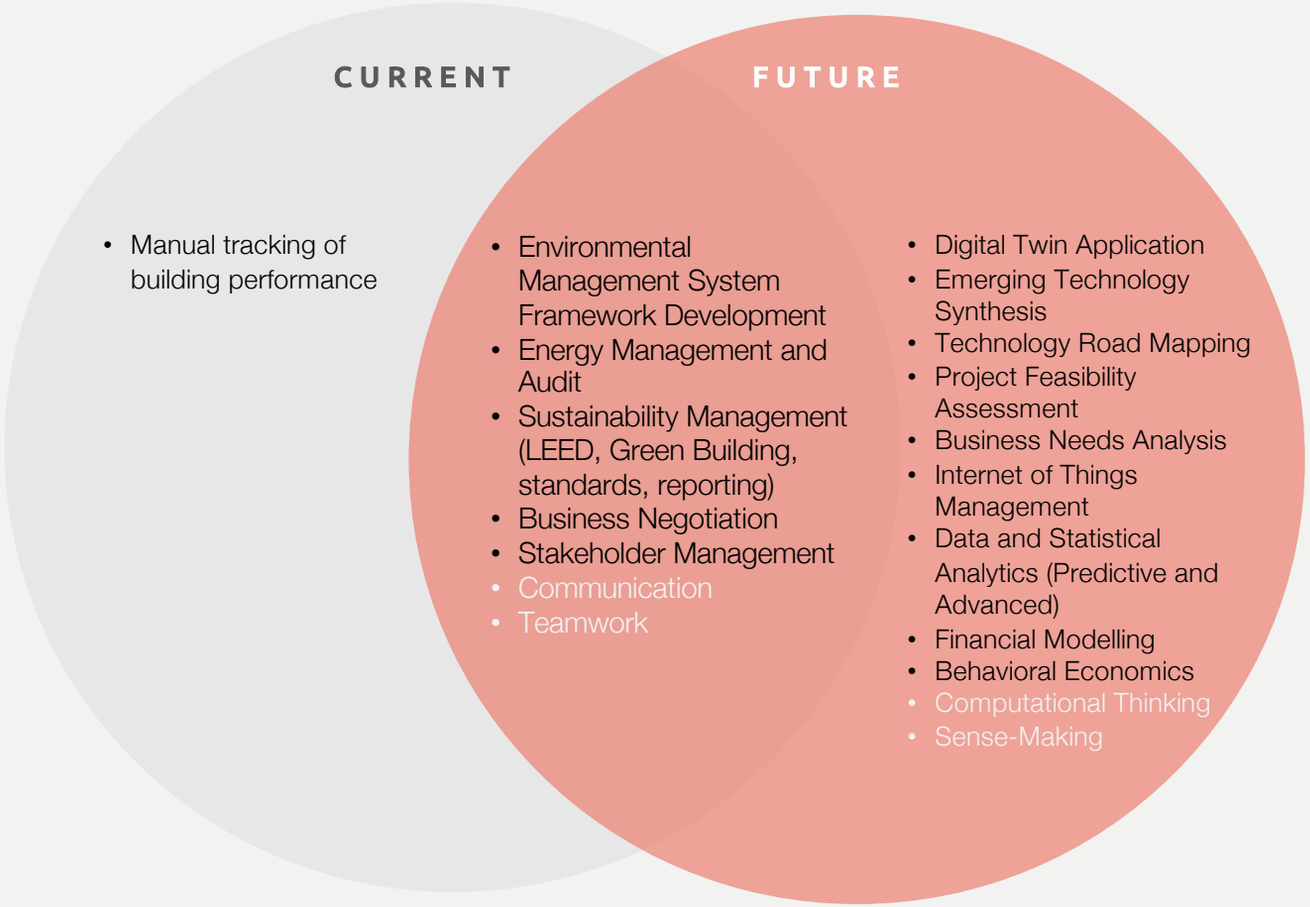
KEY RESPONSIBILITIES

- Strategise and drive implementation efforts for effective sustainable technology in buildings to maximise building efficiency (e.g. smart glass panels, insulation technologies, water management)
- Use IoT sensors or Digital Twins to collect live data and feedback for sustainability reporting, building performance monitoring, and optimization
- Provide insights on property condition and performance for asset management decisions using data analytics (e.g. predictive analytics to anticipate energy usage and management)
- Develop sustainability initiatives to actively shift user behavior and influence mindsets (e.g. sustainability campaigns, zero-waste initiatives)

The Smart Sustainability Manager builds upon the core skillset which current Engineering Services Managers are equipped with

KEY COMPETENCIES

LEGEND: ● TECHNICAL SKILLS ○ GENERIC SKILLS



WHO ELSE CAN TRANSITION INTO THIS ROLE?

SUSTAINABILITY MANAGER

Oversees development and implementation of sustainability programmes and initiatives within property development

The Digital Community Manager implements multi-channel placemaking initiatives for tenants and occupants to maximise engagement and satisfaction.

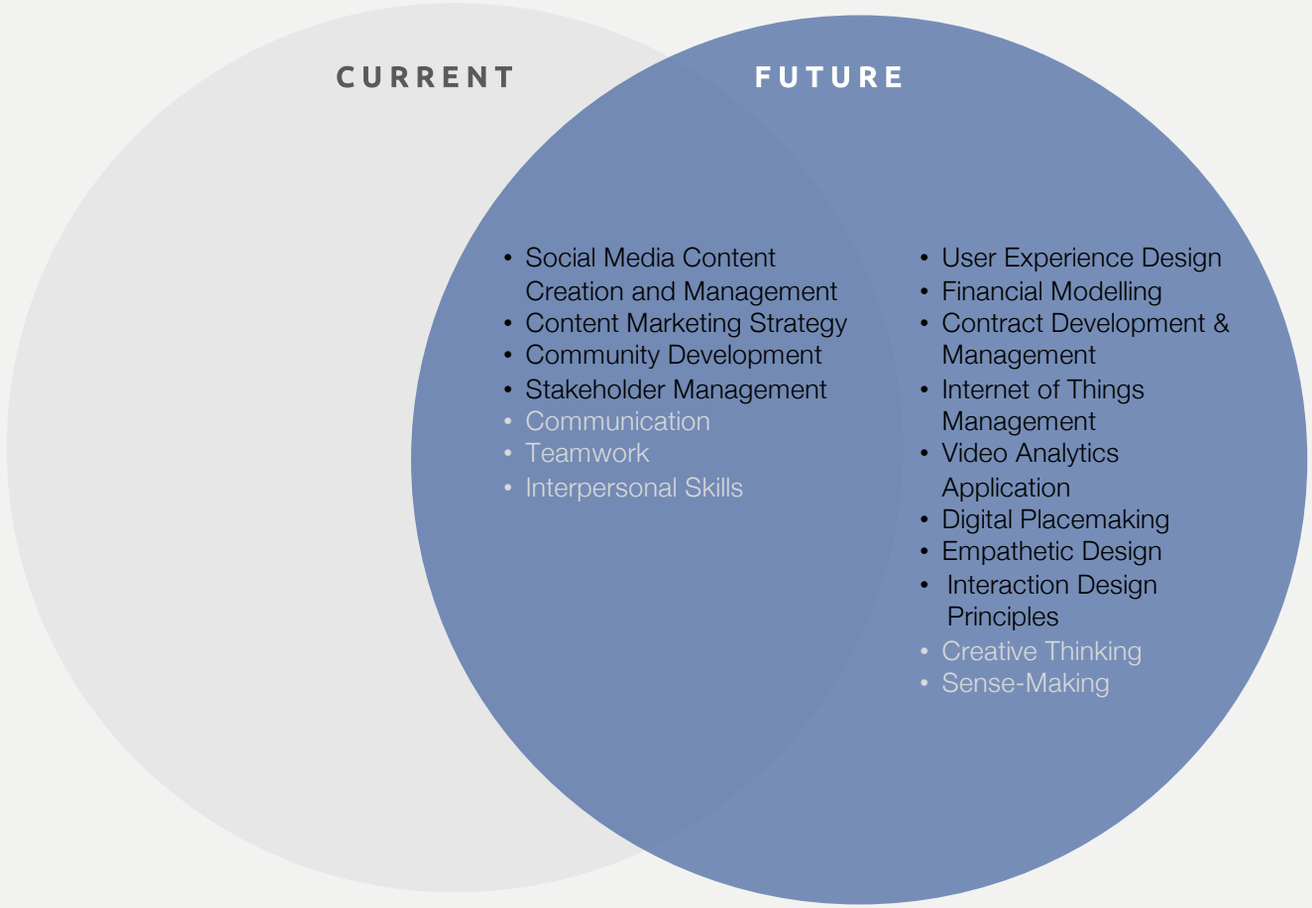
KEY RESPONSIBILITIES

- Identify latest technologies which are aligned with consumer trends to infuse into Smart Estates (e.g. autonomous scooters for user mobility within estate, beacons to connect shoppers with retail promotions)
- Incorporate experience design principles into estate offerings to enhance community experience within Smart Estates (e.g. Sensorial, memorable, and inclusive spaces)
- Track ROI of community investments and initiatives
- Implement digital and physical placemaking initiatives through effective use of digital touchpoints to engage with tenants and occupants (e.g. location-specific augmented reality, digitally-enabled services triggered by user's physical location)
- Use digital tools to gather insights on tenant and occupant behaviour (e.g. use IoT sensors and/or video analytics to monitor activity patterns, space utilisation, or user profile in learning facilities)

Community Managers can grow in their careers by acquiring key digital and analytical skills to become Digital Community Managers for future Smart Estates

KEY COMPETENCIES

LEGEND: TECHNICAL SKILLS GENERIC SKILLS



WHO ELSE CAN TRANSITION INTO THIS ROLE?

MARKETING & COMMUNICATIONS EXECUTIVE

Develop marketing strategy to strengthen branding and positioning of property and improve communication between tenants and visitors

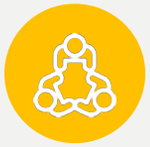
Next Steps

Image credit: tofumax via iStock

How can businesses take advantage of this talent initiative?

Use the Smart Estates Talent Playbook as a reference for upskilling, job redesign, and talent development

This playbook can help to provide guidance to develop your talent approach of the future, whether you are mapping training and development needs, charting career pathways, or conducting manpower forecasts.



Co-develop training curriculum with SSG and IHLs to address business needs

What are the key cost drivers and business challenges that your company faces? By mapping these elements, you can play a part to influence and shape the curriculum with SSG and the IHLs to address business needs such as improving productivity or reducing costs.

Send your employees for the Smart Estates Talent Development Programme

Sign up your employees for the applied training programme that will have a mix of skills training, project implementation, and mentorship. SSG funding is available to help offset course fees.

Reach out to SSG on how else we can support your talent and skills needs

SSG provides different kinds of support for individuals and companies to embark on skills upgrading, and lifelong learning. Come talk to SSG to discuss further how you can be supported in building your talent pipeline.

Appendix

Image credit: Philipp Birmes via Pexels

References

END NOTE

[1]Services 4.0 is Singapore's response to the Services and Digital Economy (SDE) Technology Roadmap, envisioning Singapore delivering next-generation services that are end-to-end, frictionless, empathic, and anticipatory to customer needs.
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Supporting Organisations

About SkillsFuture Singapore (SSG)

SkillsFuture Singapore (SSG) drives and coordinates the implementation of the national SkillsFuture movement, promotes a culture of lifelong learning and strengthens the ecosystem of quality education and training in Singapore. Through a holistic system of national SkillsFuture initiatives, SSG enables Singaporeans to take charge of their learning journey in their pursuit of skills mastery. SSG also works with key stakeholders to ensure that students and adults have access to high quality and industry-relevant training that meet the demands of different sectors of the economy for an innovative and productive workforce.

For more information, visit www.ssg.gov.sg or follow SSG on Facebook SkillsFuture SG and LinkedIn SkillsFuture-SG.

About the Infocomm Media Development Authority (IMDA)

The Infocomm Media Development Authority (IMDA) leads Singapore's digital transformation with infocomm media. To do this, IMDA will develop a dynamic Digital Economy and a cohesive digital society, driven by an exceptional infocomm media (ICM) ecosystem – by developing talent, strengthening business capabilities, and enhancing Singapore's ICM infrastructure. IMDA also regulates the telecommunications and media sectors to safeguard consumer interests while fostering a pro-business environment, and enhances Singapore's data protection regime through the Personal Data Protection Commission.

For more news and information, visit www.imda.gov.sg or follow IMDA on Facebook IMDAsg and Twitter @IMDAsg.

Building and Construction Authority

About the Building and Construction Authority (BCA)

The Building and Construction Authority (BCA) of Singapore champions the development of an excellent built environment for Singapore. BCA's mission is to shape a safe, high quality, sustainable and friendly built environment, as these are four key elements where BCA has a significant influence. In doing so, it aims to differentiate Singapore's built environment from those of other cities and contribute to a better quality of life for everyone in Singapore. Hence, its vision is to have "a future-ready built environment for Singapore". Together with its education arm, the BCA Academy of the Built Environment, BCA works closely with its industry partners to develop skills and expertise that help shape a future-ready built environment for Singapore.

For more information, visit www.bca.gov.sg.

eden strategy institute

About Eden Strategy Institute

Eden Strategy Institute is a strategy consulting firm specializing in Business System Innovation. We approach the global issues of urbanization, disease, poverty, illiteracy, and exploitation by formulating strategies, models, processes, and products that help our clients create, realize, and sustain their economic impact. Eden plans and sets up industry blueprints, facilitates co-creation workshops, forecasts and evaluates the impact of policy interventions. We have supported governments and corporations to successfully bring Smart City innovations to market using qualitative and quantitative research, engineering, business planning, partnerships, and impact assessment.

To learn more about our work, please visit
www.edenstrategyinstitute.com